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THE SEPARATION OF SEED BARLEY BY THE SPECIFIC GRAVITY METHOD.

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[Cir. 62]

2

THE SEPARATION OF SEED BARLEY BY THE SPECIFIC GRAVITY METHOD.

INTRODUCTION.

The yield per acre of barley in the United States in 1909 was $24\frac{3}{16}$ bushels, which is $1\frac{2}{3}$ bushels less than the 10-year average from 1900 to 1909. A large part of the crop of 1909 was of poor quality and light weight, weighing much less than 48 pounds per bushel, the standard weight.

The six-rowed barleys are principally grown in this country. The head in this type of barley is made up of spikelets arranged in groups of three upon the rachis. These contain one median and two lateral grains. The median grain, having sufficient space to develop, is usually large and plump, resembling that of the two-rowed type. The lateral grains overlap each other, so that they are usually smaller, twisted, and under unfavorable conditions inclined to be chaffy. Experiments show that the plants produced from these lighter grains are inferior to those grown from the larger median ones and frequently do not produce as good grain. For this reason the seed for planting should be thoroughly sorted and cleaned before seeding. The method described here is recommended as a satisfactory means of accomplishing this purpose.

THE SPECIFIC GRAVITY METHOD OF SEED SEPARATION.

The specific gravity method of seed separation consists in the immersion of the seed in liquids of varying density. These different densities are obtained by the addition of various quantities of salts or other agents by which the specific gravity of the liquid is increased or decreased, as desired. When different kinds of seeds are immersed in these solutions, those which are lower in specific gravity than the liquid in which they are placed will float on the surface. The strength of the solutions must be varied for the different kinds of seeds to be treated. In the separation of barley, however, water can be successfully used.

THE SPECIFIC GRAVITY METHOD AS APPLIED TO THE SEPARATION OF SEED GRAIN.

A simple plan for separating seed barley by the specific gravity method has been successfully used by the Office of Grain Investigations during the past year. The apparatus used consists of two tubs or

half barrels with a hole bored at the bottom of each and fitted with a pine plug. On the inside of the tub fine wire netting is tacked over the hole to prevent the loss of grain. Rope handles fitted in holes bored near the top facilitate handling. One tub is set above the other, as shown in figure 1.

The method of procedure used in separating the grain is as follows: The upper tub is filled two-thirds full of water and the seed barley poured in, enough space being left to allow thorough stirring. The plump barley grains will sink to the bottom, while the light and shriveled barley and many of the oat and weed seeds will float on



FIG. 1.—Tubs showing a convenient arrangement for removing undesirable barley grains and oat and weed seeds from seed barley by the specific gravity method.

the surface when the grain is stirred. After stirring thoroughly, the grain that floats should be carefully skimmed off. When the skimming is completed, the plug should be pulled out and the water allowed to drain into the tub beneath. The grain should then be emptied from the upper tub upon a clean floor or a piece of canvas and spread out thinly to dry. The tubs can then be reversed and the operation repeated with another lot of grain. In order to dry the grain and prevent it from sprouting it should be stirred occasionally with a clean garden rake or shovel.

This selected seed should be sown as soon as it is sufficiently dry to run through the drill. As the seed will be somewhat swollen, the

rate of seeding should be proportionately increased. Seed treated in this manner will be free from small and weak grains, and a better stand and greater yield will be secured from it than from ordinary seed.

This method is not to take the place of the fanning mill, but is to be used in connection with it. It will remove many of the small grains and weed seeds not removed by that machine. Where the fanning mill is not available the treatment here described will be found of great value.

If it is desired to treat the seed for smut, the sorting and treating operations can be combined by substituting for the water a formalin solution at the rate of 1 pound of formalin to 40 gallons of water, as described in Farmers' Bulletin No. 250.

THE GENERAL USE OF THE SPECIFIC GRAVITY METHOD.

The separation and selection of seeds by the specific gravity test has been practiced, according to Yokoi,^a in China and Japan for more than two hundred and fifty years. Hellreigel, Rümpler, Nobbe, and many other European investigators have carried on similar experiments. Rümpler,^b from the results secured in his experiments in the separation of barley seed with solutions of sodium nitrate, advised planting only the heaviest third of the seed.

The separation of seed by the specific gravity method is not new in the United States. The simple plan of placing lettuce and other vegetable seeds in a dish of water and skimming off the light seeds and chaff has been practiced among the Pennsylvania Dutch and their descendants for many years. Lack of knowledge of the process probably accounts for the fact that it has not come into general use. Dr. T. L. Lyon, of the Agricultural Experiment Station of Nebraska,^c made selections of wheat by the specific gravity method and secured an increased yield from the heavier seed. Prof. H. Garman, of the Kentucky Agricultural Experiment Station,^d removed weed seeds from hemp seed by this method. Probably the most important work along this line, however, was done by Prof. V. A. Clark, of the New York Agricultural Experiment Station,^e who conducted numerous experiments with a large number of vegetable seeds, grape seeds, etc. Among his conclusions the following may be cited:

Specific gravity may be utilized as a means of separating foreign matter, or, occasionally, foreign seeds. * * * A quite definite correlation exists between the

^a Yokoi, T. Bulletin, Imperial University, College of Agriculture (Tokyo), vol. 3, no. 5, pp. 421-439.

^b Deutsche Landwirtschaftliche Presse, Berlin, 1896, p. 194.

^c Bulletin 72, Agricultural Experiment Station of Nebraska.

^d Bulletin 105, Kentucky Agricultural Experiment Station.

^e Bulletin 256, New York Agricultural Experiment Station.

specific gravity of a seed and its germination. Seeds of low specific gravity do not germinate at all. Seeds of highest specific gravity, or in the case of oil-bearing seeds those of intermediate specific gravity, show the highest percentage of germination.

* * * To some extent a correlation appears to exist between the specific gravity of the seed and the vigor of the resulting plant.

SUMMARY.

The yield to the acre of barley in the United States in 1909 was $1\frac{1}{2}$ bushels less than the ten-year average from 1900 to 1909.

The quality of a considerable part of the crop was inferior and the germinating power consequently low.

The six-rowed barleys predominate in the United States. Owing to the arrangement of the spikelets upon the rachis in this type, there are twice as many smaller, twisted grains as large, plump grains. It is these small, chaffy grains that cause decreased stands. Fanning or screening will not always remove them; the specific gravity method will.

The specific gravity method here proposed is the immersion of the seed barley in a tub or barrel of water and thoroughly stirring it. The greater portion of the undesirable seeds will float and can be skimmed off.

The seed can be treated for smut in the same operation by adding formalin at the rate of 1 pound to 40 gallons of water.

The specific gravity method is not new. It has been used in China and Japan for two hundred and fifty years. Experiments conducted in Europe and the United States in which salt solutions were used in the specific gravity test demonstrate its value in seed separation.

Approved:

JAMES WILSON,

Secretary of Agriculture.

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